The Entomological Society of America (ESA), Entomological Society of Canada (ESC), and the Entomological Society of British Columbia (ESBA) Joint Annual Meeting November 13-16, 2022 in Vancouver, British Columbia, Canada

https://entsoc.org/events/annual-meeting/2022-jam

Dates of travel: 12-16 November 2022

Name of GCRI travel grant recipient: Dr Michelle Fountain

View of Vancouver from Stanley Island

Highlights

Discussion session on codling moth mating disruption successes and failures
Latest *Drosophila suzukii* (SWD) research findings
Evening viewing of film: *My Garden of a Thousand Bees*
Merging entomology and art
Corporate Exhibition
Diverse topics covered in the poster session
Talks on the conservation of solitary bees in agricultural landscapes
Visit to Agassiz Research & Development Centre

Background

ESA conferences always have a wide diversity of topics and events. Hence, they are not only focused on agriculture, horticulture and insect conservation but have a wide variety of entomological topics examining the behaviour, semiochemistry, veterinary and human health, basic biology, and wider human social impacts of insects all over the world. The conferences are an opportunity to experience what is happening in other parts of the world, widen views on the importance of insects to ecosystems and people, and catch up with industry collaborators at the exhibition. In addition, they are a chance to reconnect with academic collaborators working in similar fields of research and exchange ideas and form new partnerships. This conference was particularly interesting to me because it merged entomology and art and included talks from musicians and artists. It was also unflinching in its address for a stronger focus on Equality, Diversity and Inclusiveness on the people who participate in entomological science.

Travel findings

The conference was based in Vancouver on the shore of Vancouver Bay at the Convention Centre. Because the event was so varied in topics and diverse in participants, it allowed international scientists to meet and exchange knowledge relevant to their geographical locations, which might also inform horticulture in the UK.

The number of parallel sessions is always challenging at these events, as many interesting topics may run simultaneously. Although my focus was on the fruit protection sessions, I also attended talks on the conservation and behaviour of solitary bees, plenary sessions on the lack of women, First Nation and endemic societies in top scientific positions in research institutes and the art session which included creating music from insect driven data and exhibitions using pinned insect museum specimens to highlight the diversity and decline in insects to the wider public. Please check out a children's book written by an entomologist to highlight the diversity of bees. It has fantastic illustrations and is very amusing; *Am I Even a Bee?* by Dr Felicity Muth (author) and Alexa Lindauer (illustrator).

I did not attend the insect amuse bouche, which involved bite-sized morsels of insects for tasting.

I presented *Control of Drosophila suzukii (SWD) in fruit crops using Sterile Insect Technique (SIT)* on Sunday, 13 November. This was in the Invasive Species session chaired by Michelle Franklin and Yonathan Uriel from the Agassiz Research and Development Centre in British Columbia. Given the importance of SWD to fruit production and world economics, the room was standing room only for most talks on this pest. The project I presented is IUK funded project led by BigSis, who produce the sterile flies. NIAB East Malling is carrying out much of the scientific testing and is supported by Berry Gardens, who have paved the way for commercial assessment of the strategy in the UK. Irradiated SIT for SWD control is a world first.

In some parts of the USA, weekly sprays are applied to control SWD. In California, there are now zeta-cypermethrin and spinosad resistant populations, and this resistance did not disappear after 10 generations of non-exposure in the laboratory. Like the UK, the US is looking for alternative IPM approaches to control, including bait sprays – also investigated in AHDB and IUK-funded projects at NIAB East Malling. In contrast to the UK, many parts of the US and Canada are now able to release non-native parasitoids (e.g. *Gnapsis* spp.) to help keep SWD populations under control. The advantage of the 'home-range' parasitoids is that they are better adapted to parasitise SWD. It is early days for these releases and so too early to conclude the impact on SWD control and fruit damage. In some areas, there has been the adventive occurrence of non-native SWD parasitoids, presumably travelling inside the larvae of imported fruit. As a result of this information, on return from Vancouver, we revisited our UK-collected parasitoid samples, but to date have not found parasitoids from the home range of SWD. One of the talks noted the complex interactions between SWD and its parasitoids with some competitive and facultative interactions. For example, deploying two parasitoid species may better control SWD than one. This is because the first can weaken SWDs immune system allowing the second parasitoid species to parasitize SWD larvae successfully. Along the West Coast of the US, although there have been releases of *Gnapsis*, very few are being recaptured, although another non-native parasitoid, *Leptopilina japonica*, is being found in most areas. One interesting finding was that parasitoids can detect the vibration of SWD larvae in fruit and only lay eggs when this vibration is detected. This is interesting as it relates to findings in a recently completed NIAB East Malling BBSRC-

funded project, where SWD avoid fruits that contain the live larvae of other Drosophila species… are they eavesdropping? In another talk, mass releases of the parasitoid *Trichopria* were evaluated. The result was more *Trichopria* than *Pachycrepoideus vindemmiae* compared to control sites but no extra control in the pest. Hence the parasitoid population was switched with no extra control in SWD.

Another important future potential invasive species is the Spotted Lanternfly. This attractive planthopper species has spread from Asia to many parts of the USA where it is a significant pest of vineyards sucking on the sap and creating copious amounts of honeydew, resulting in fungal pathogens. It is highly dispersive in targeting host plants. It is, however, not a pest of apples.

Brown marmorated stink bug (BMSB) was also a big topic of the conference, with a focus on strategies for IPM. The only currently effective management options are broad-spectrum insecticides which, as we know, disrupt other biological controls and are largely not available in the UK and Europe. Although insect-excluding mesh works well, this is labour intensive and may cause other problems in the crop. Like other parts of the world, BMSB initially and gradually builds up in 'heat islands' such as cities. In the UK, London seems to be a focus of the most sightings, with females detected in the last two years (NIAB East Malling Defra funded project).

I also attended the codling moth (CM) control session. Originally from Kazakstan, the codling moth is becoming increasingly difficult to control since the withdrawal of many insecticides. This is also likely to be an increasing issue in the UK. CM has 58 odour receptors, with even some detected in the female ovipositor. Work continues to find female-attractive odours for use in control as female moths live for 1-2 weeks and, during that time, if mated, lay many eggs. Orchards with clear ground and trees with smooth bark are believed to have fewer problems with CM, but the drive towards low residue and organic apple production is making control challenging. Control is only achievable on an area-wide basis. There are now a range of mating disruption (MD) products available in the US, but area-wide suppression is key to control. One untreated farm in the middle of an area-wide MD landscape makes MD invalid; hence there is a social component to CM control which involves all players in a geographical area. MD can reduce the need to spray from 3.5 to 1 application per year. If MD is temporarily halted, populations rebuild. However, MD is more expensive than pesticides. Ninety percent of the area of pome fruit production in Washington State is treated with MD. Compared to MD of Oriental Fruit Moth (OFM), CM MD is not as reliable. This is thought to be because the pheromone of OFM arrests the flight of the males, whereas the pheromone of CM does not arrest flight. Consequently, reducing pheromone MD dispensers from 400 to 200 per acre, to reduce costs, reduces the efficacy of the MD strategy. Hence, with CM, the number of dispensers is important with one study suggesting that up to 3000 / acre would be needed if not incorporated with insecticides; hence, CM MD is density dependent. During the discussion, it was highlighted that growers should consider CM hotspots in orchards and reach beyond the borders of fields with pheromones being part of a systems approach. One monitoring trap per acre was inadequate for monitoring, which could be resolved with remote camera traps to identify hotspots of CM. MD needs to be incorporated with insect growth regulators (IGRs), mineral oils, granulosis virus, earwigs, orchards sanitation and nematodes.

Strawberry blossom weevil (SBW) is becoming a problem in many parts of Canada and Northern Europe on raspberry and strawberry. It is suggested that populations are supported by the invasive

species, Himalayan blackberry, now widespread in many areas. Unfortunately, parasitoid control of SBW is not achieved via the main parasitoid *Pteromalus* spp.

Chilli thrips, *Scirtothrips dorsalis*, is causing fruit damage on strawberry crops in Florida including bronzing of the leaves and fruits and should be highlighted as a future potential problem for UK glasshouse production.

There was an interesting talk on pear psylla control in Wenatchee Valley and how the change to IPM management from regular spraying is not being achieved due to a perceived risk of it not working. Studies demonstrated that IPM of pear psylla costs 1140 USD/ha compared to conventional spraying 1425 USD/ha, with inadequate control in the latter. IPM controls include using the phenology model to time sprays of kaolin and IGRs, summer pruning to remove new shoots, tree washing. In addition, there were a higher number of overwintering adults in conventional orchards compared to IPM orchards. Biotremology is a relatively new topic of pest control and modern growing techniques on support structures offer an opportunity to explore this. Research on pear psylla to date has been inconclusive but researchers continue to fine-tune the strategy.

It was great to see applied studies on relocating the common European earwig from stone fruit orchards in Northwest USA to pome fruits for pest control. The researchers are releasing 50,000 earwigs annually by mass releasing 500 earwigs per week in apple and pear orchards. There are early indications that this is reducing woolly apple aphid and European red mite in apple orchards and psyllids in pear orchards.

Pollination deficits were identified in several crops, for example outdoor grown tomatoes and melons, highlighting the need to increase and improve habitat for wild pollinators. There are opportunities for increasing habitat quality for insects, such as large areas on golf courses, but this will need a mindset change, which may take some time. Solitary bees are not only important in many fruit crops for pollination but an important part of soil biodiversity with most species spending the majority of the year belowground. This is a factor forgotten in their management and conservation. *Halictus ligatus* is the most prevalent solitary bee species in North America's agricultural landscapes, but ground nesting areas are scarce in monoculture landscapes. The importance of soil structure was highlighted at the conference and agrees with findings by a NIAB East Malling PhD student recently published https://www.pollinationecology.org/index.php/jpe/article/view/682

At the end of the conference, I drove west to visit Michelle Franklin and colleagues at the Agassiz Research & Development Centre located in Agassiz, British Columbia and established in 1886 by the Government of Canada under The Experimental Farm Station Act. We covered a range of topics from SBW, to SWD parasitoids and biotremology to control pests. We hope to collaborate in the future on SWD genetics.

Personal statement

As a UK-based fruit crop entomologist, I was very pleased to have the opportunity to attend this conference, learning more about fruit entomology and networking with scientists, plant protection specialists and industry. Clearly, insect pest issues, conservation and biodiversity are a subject of global importance. The meeting demonstrated how comparable and cutting-edge UK fruit entomological research is, but also brought new ideas to the table that the UK fruit industry could incorporate into crop management. Given the current economic constraints that the UK fruit industry faces, it is easy

to forget about the pests and diseases that challenge production. However, as an industry, we must continue to be vigilant to pests and diseases in crops whilst building insect numbers and biodiversity to support a more resilient and productive ecosystem, not just for human food but for the health and well-being of our unique habitats and wildlife.

And what do entomologists do at a conference to relax?, watch a film entitled *My Garden of a Thousand Bees* which follows wildlife filmmaker Martin Dohrn. During lockdown, he focussed on the extraordinary life of bees living in his urban garden in Bristol, England. I fully recommend this film which is available through links at;

https://www.mygardenofathousandbees.com/#:~:text=My%20Garden%20of%20a%20Thousand%20Bees%20follows%20acclaimed%20wildlife%20filmmaker,urban%20garden%20in%20Bristol%2C%20England.

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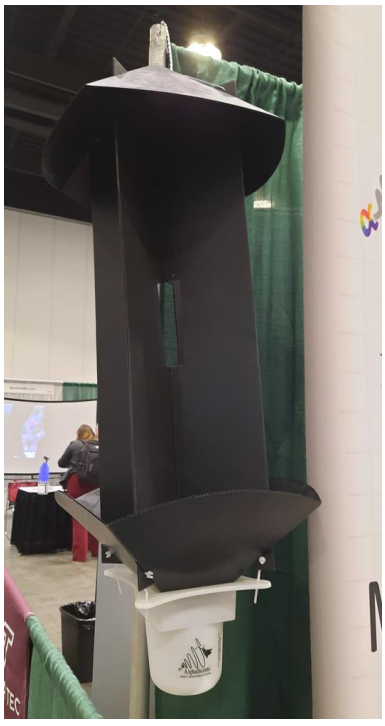
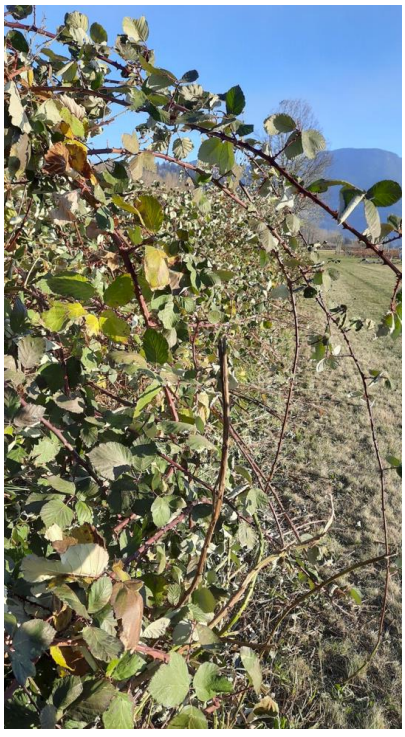
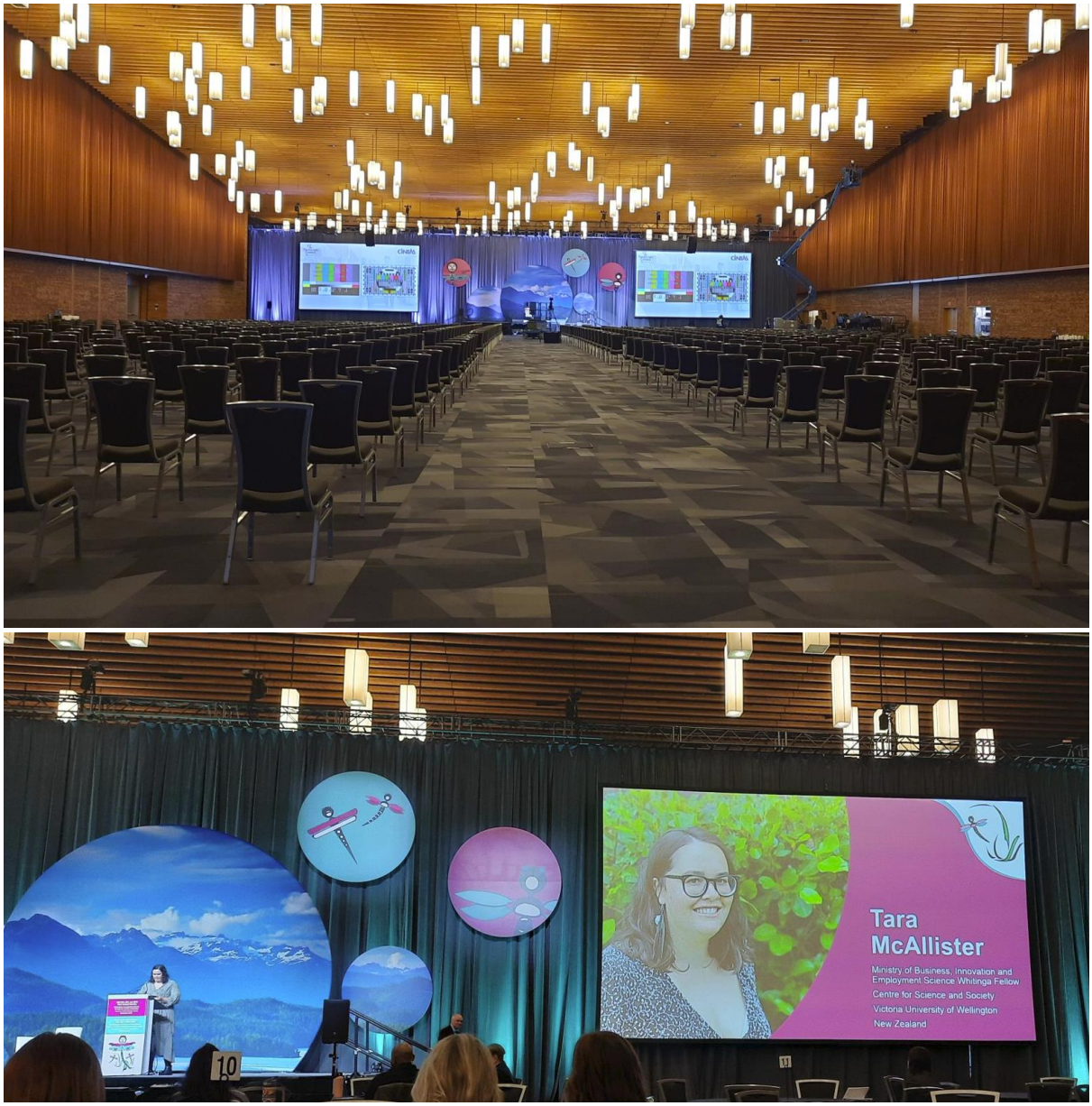
a)  b) 

a) Large mass trapping device for Ambrosia beetles and b) Himalayan blackberry in British Colombia, a source of *Drosophila suzukii.*



Above: plenary meeting room. Below: Tara McAllister giving a Maori perspective of research in New Zealand.